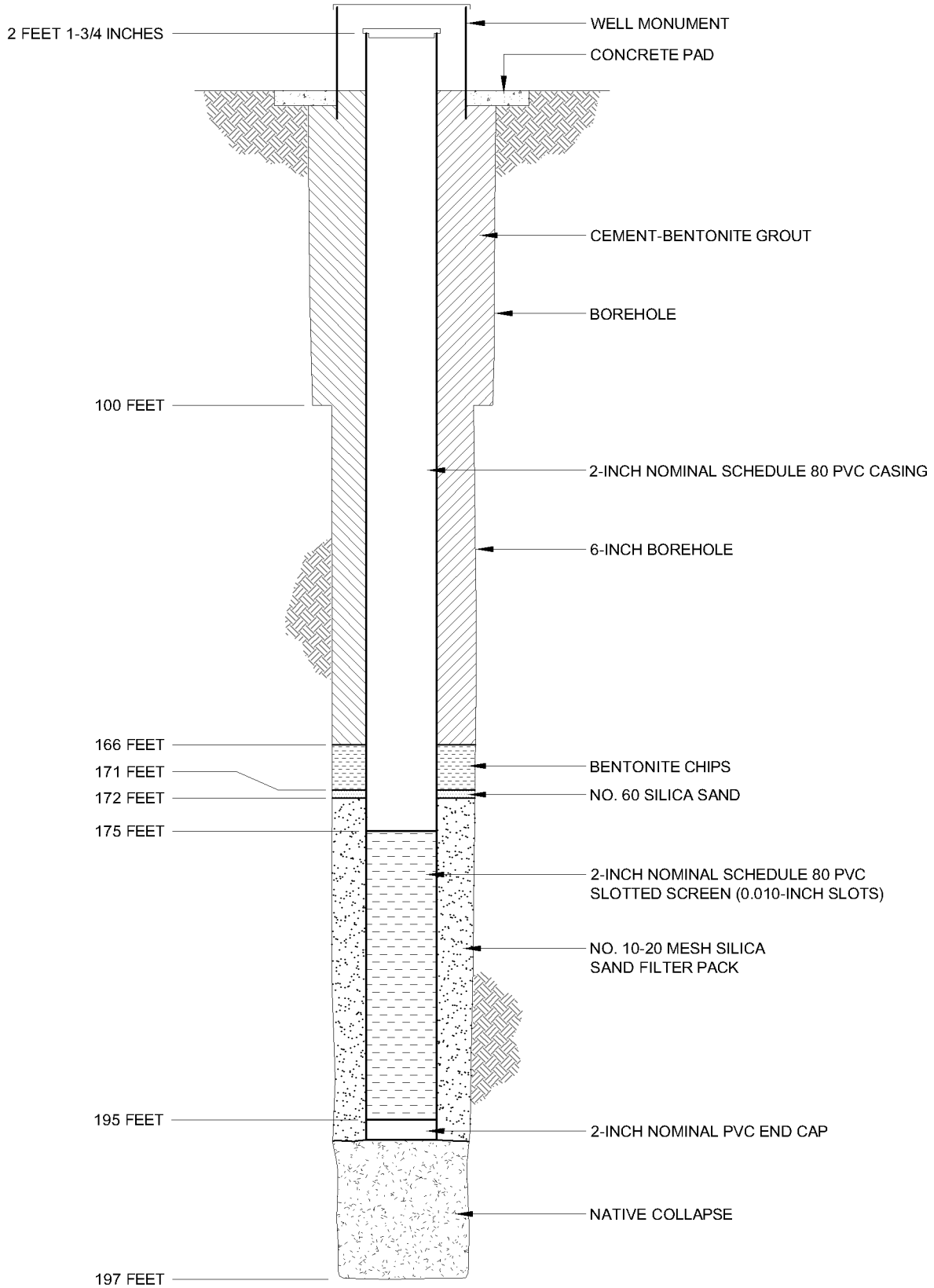

NOT TO SCALE

BROWN AND CALDWELL	Date: March 2008 Atlantic Richfield Company Project: 134557		**Well B/W-22** **Construction Details**

Brown and Caldwell

Carson City, Nevada

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 1 **of** 11

Boring Location: One mile south of the junction of Luzier Lane and Locust Lane		**Northing:**	**Easting:**
Drilling Contractor: Boart Longyear	**Driller:** D. Reed	**Top of PVC Elevation:** feet amsl **Ground Surface Elevation:** feet amsl	
Drilling Equipment: GP24-300RS	**Borehole Diameter:** 6-inches	**Date Started:** 7/14/07	**Date Finished:** 7/18/07
Drilling Method: Sonic	**Drilling Fluid:** Water	**Completed Depth:** 197 fbgs	**Water Depth:** fbmp
Sampling Method: Core Barrel		WELL CONSTRUCTION	
Well Seal: Bentonite and Cement		**Type and Diameter of Well Casing:** 2-inch Schedule 80 PVC	
Logged By: R. Banda and C. Strauss		**Slot Size:** 0.010 inch	**Filter Material:** #10-20 Silica Sand

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
5		SM	**Silty Sand (0 - 5.5)** Dry, loose, no odor. Primarily medium to fine sand with ~10% gravel to 15 mm and ~30% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, have a light brown color, and have a weak reaction to HCl.					Description of drilled cuttings based on ASTM Method D-2488 (the visual-manual procedure), grain-size determinations and nomenclature based on the Unified Soil Classification System. Horizontal Survey data is expressed in the Nevada State Plane system, Nevada West zone, in feet. Sharp contacts indicated by solid lines, gradational contacts indicated by dashed line. All depths are below land surface unless stated otherwise.
		SW-SM	**Well-Graded Sand with Silt (5.5 - 9.5)** Dry, loose, no odor. Primarily medium to fine sand with ~10% gravel to 15 mm and ~15% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and have a strong reaction to HCl.					WELL DESIGN for B/W-22: PVC Stickup: feet. Cement - Bentonite Grout: 0 - 166 feet Bentonite Chips: 166 - 171 feet No. 60 Silica Sand: 171 - 172 feet #10-20 Silica Sand Filter Pack: 172 - 195 feet 2-inch Nominal Schedule 80 PVC 0.010 Slotted Screen: 175 - 195 feet Native Collapse: 195 - 197 feet Additional Bentonite Fill: NA feet
10		CL	**Sandy Lean Clay (9.5 - 11)** Dry, dense, no odor. Primarily silt and clay with ~5% gravel to 10 mm and ~30% medium to fine grained sand. The sand and gravel are subangular to subrounded. The fines have low plasticity and toughness, and have a strong reaction to HCl.					Number of wells at this location: 1 Screen intervals for paired wells are labeled at the installed depths.
		SM	**Silty Sand (11 - 14)** Dry, loose, no odor. Primarily medium to fine sand with ~10% gravel to 20 mm and ~30% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and do not react to HCl.					
		SM	**Silty Sand with Gravel (14 - 16)** Dry, loose, no odor. Primarily medium to fine sand with ~35% gravel to 30 mm and ~20% fine grained					

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 2 **of** 11

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
			sand. The gravel is angular to subangular and the sand is subangular to subrounded. The fines are nonplastic, and do not react to HCl.					
		SW-SM	**Well-Graded Sand with Silt and Gravel (16 - 22.5)** Dry, dense, no odor. Primarily medium to fine sand with ~15% gravel to 25 mm and ~15% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, have a reddish brown color, and have a strong reaction to HCl.					
20								
		SM	**Silty Sand with Gravel (22.5 - 23)** Dry, dense, no odor. Primarily medium to fine sand with ~15% gravel to 20 mm and ~30% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, have a brown color, and have a strong reaction to HCl.					
		SW	**Well-Graded Sand (23 - 25)** Dry, dense, no odor. Primarily medium to fine sand with ~10% gravel to 15 mm and ~10% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, have a brown color, and have no reaction to a weak reaction to HCl.					
25		SW-SM	**Well-Graded Sand with Silt and Gravel (25 - 27.5)** Dry, dense, no odor. Primarily medium to fine sand with ~15% gravel to 50 mm and ~15% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, have a reddish brown color, and do not react to HCl.					
		SW-SM	**Volcanic Tuff (27.5 - 28)** Dry, dense, no odor. The fines are nonplastic, and have a strong reaction to HCl.					
			Well-Graded Sand with Silt and Gravel (28 - 33.5) Dry, dense, no odor. Primarily medium to fine sand with ~15% gravel to 20 mm and ~25% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
30								
		SM	**Silty Sand (33.5 - 37)**					

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 3 **of** 11

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
35			Dry, dense, no odor. Primarily medium to fine sand with ~5% gravel to 10 mm and ~40% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and do not react to HCl.					
		SM	**Silty Sand with Gravel (37 - 43)** Dry, dense, no odor. Primarily medium to fine sand with ~15% gravel to 20 mm and ~30% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a weak to strong reaction to HCl.					
40								
		CL	**Sandy Lean Clay with Gravel (43 - 45)** Dry, dense, no odor. Primarily silt and clay with ~15% gravel to 15 mm and ~30% medium to fine grained sand. The sand and gravel are subangular to subrounded. The fines have low plasticity and toughness, and have a weak to strong reaction to HCl.					
45		SW-SM	**Well-Graded Sand with Silt and Gravel (45 - 50.5)** Dry, very dense, no odor. Primarily medium to fine sand with ~15% gravel to 15 mm and ~15% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a weak to strong reaction to HCl.					
50		SM	**Silty Sand (50.5 - 52)** Dry to moist, dense, no odor. Primarily silt and clay with ~5% gravel to 15 mm and ~40% medium to fine grained sand. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
		SW-SM	**Well-Graded Sand with Silt and Gravel (52 - 58)** Dry, very dense, no odor. Primarily medium to fine					

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 4 **of** 11

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
55			sand with ~15% gravel to 15 mm and ~15% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a weak to strong reaction to HCl.					
60		SW-SM	**Well-Graded Sand with Silt (58 - 60)** Dry, dense, no odor. Primarily medium to fine sand with ~10% gravel to 15 mm and ~20% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
		SW-SM	**Well-Graded Sand with Silt (60 - 63)** Dry, very dense, no odor. Primarily medium to fine sand with ~10% gravel to 20 mm and ~30% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
65		SM	**Silty Sand (63 - 66)** Dry, dense, no odor. Primarily medium to fine sand with ~5% gravel to 10 mm and ~40% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
		SM	**Silty Sand (66 - 68.5)** Dry, dense, no odor. Primarily medium to fine sand with ~5% gravel to 20 mm and ~20% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and have a strong reaction to HCl.					
70		SM	**Silty Sand (68.5 - 73)** Dry, dense, no odor. Primarily medium to fine sand with ~5% gravel to 10 mm and ~30% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 5 **of** 11

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
		SM	**Silty Sand (73 - 74)** Dry, very dense, no odor. Primarily silt and clay with ~5% gravel to 20 mm and ~30% medium to fine sand. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
		SM	**Silty Sand with Gravel (74 - 82.5)** Dry, dense, no odor. Primarily medium to fine sand with ~20% gravel to 20 mm and ~30% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have no reaction to a weak reaction to HCl.					
75								
80								
		SM	**Silty Sand (82.5 - 84)** Dry, very dense, no odor. Primarily medium to fine sand with ~5% gravel to 20 mm and ~40% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
		SM	**Silty Sand with Gravel (84 - 86.5)** Dry, very dense, no odor. Primarily medium to fine sand with ~15% gravel to 25 mm and ~20% silt and clay. The gravel is angular to subangular and the sand is subangular to subrounded. The fines are nonplastic, and have a strong reaction to HCl.					
85								
		SM	**Silty Sand (86.5 - 88)** Dry, very dense, no odor. Primarily silt and clay with ~10% gravel to 15 mm and ~30% medium to fine grained sand. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
		SW-SM	**Well-Graded Sand with Silt (88 - 89.5)** Dry, very dense, no odor. Primarily medium to fine sand with ~5% gravel to 30 mm and ~20% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and have a strong reaction to HCl.					
90		SM	**Silty Sand (89.5 - 91)** Dry, very dense, no odor. Primarily medium to fine sand with ~10% gravel to 15 mm and ~30% silt and					

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 6 **of** 11

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
		SW	clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
			Well-Graded Sand (91 - 93.5) Dry, very dense, no odor. Primarily medium to fine sand with ~5% gravel to 15 mm and 10% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a weak reaction to HCl.					
		SM	**Silty Sand (93.5 - 96)** Dry, very dense, no odor. Primarily medium to fine sand with ~10% gravel to 15 mm and ~30% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and have a strong reaction to HCl.					
95								
		SM	**Silty Sand with Gravel (96 - 97)** Dry, very dense, no odor. Primarily medium to fine sand with ~20% gravel to 20 mm and ~20% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
		SW	**Well-Graded Sand with Gravel (97 - 106)** Dry, very dense, no odor. Primarily medium to fine sand with ~15% gravel to 25 mm and ~10% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a weak to strong reaction to HCl.					
100								
105								
		SM	**Silty Sand (106 - 107.5)** Dry, very dense, no odor. Primarily medium to fine sand with ~10% gravel to 15 mm and ~30% silt and clay. The gravel is angular to subangular and the sand is subangular to subrounded. The fines are nonplastic, and have a weak to strong reaction to HCl.					
		SM	**Silty Sand (107.5 - 109)** Dry, very dense, no odor. Primarily medium to fine sand with ~5% gravel to 15 mm and ~40% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and have a strong reaction to HCl.					
		SM	**Silty Sand (109 - 111)**					
110								

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 7 **of** 11

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
			Dry, very dense, no odor. Primarily medium to fine sand with ~10% gravel to 15 mm and ~30% silt and clay. The gravel is angular to subangular and the sand is subangular to subrounded. The fines are nonplastic, and have a weak to strong reaction to HCl.					
		SW	**Well-Graded Sand with Gravel (111 - 114.5)** Dry, dense, no odor. Primarily medium to fine sand with ~15% gravel to 25 mm and ~10% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a weak to strong reaction to HCl.					
115		CL	**Gravelly Lean Clay (114.5 - 116)** Dry, very dense, no odor. Primarily silt and clay with ~20% gravel to 25 mm and ~20% coarse to fine grained sand. The sand and gravel are angular to subangular. The fines have low plasticity and toughness, and have a weak to strong reaction to HCl.					
		SW	**Well-Graded Sand with Gravel (116 - 118)** Dry to moist, dense, no odor. Primarily medium to fine sand with ~25% gravel to 25 mm and ~10% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a weak to strong reaction to HCl.					
		SM	**Silty Sand (118 - 119)** Dry, very dense, no odor. Primarily medium to fine sand with ~5% gravel to 15 mm and ~30% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
		SW-SM	**Well-Graded Sand with Silt (119 - 121)** Dry, very dense, no odor. Primarily medium to fine sand with ~10% gravel to 30 mm and ~15% silt and clay. The gravel is angular to subangular and the sand is subangular to subrounded. The fines are nonplastic, and have a weak reaction to HCl.					
120		SC	**Clayey Sand (121 - 122)** Dry, very dense, no odor. Primarily medium to fine sand with ~5% gravel to 10 mm and ~40% silt and clay The sand and gravel are angular to subangular. The fines are nonplastic, and do not react to HCl.					
		SW	**Well-Graded Sand (122 - 124.5)** Dry, dense, no odor. Primarily medium to fine sand with ~10% gravel to 15 mm and ~10% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and do not react to HCl.					
		SW	**Well-Graded Sand with Gravel (124.5 - 125.5)** Dry to moist, dense, no odor. Primarily medium to fine sand with ~30% gravel to 20 mm and ~15% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a weak reaction to HCl.					
125		CL	**Sandy Lean Clay with Gravel (125.5 - 127)** Dry to moist, very dense, no odor. Primarily silt and clay with ~25% gravel to 15 mm and ~20% medium to fine grained sand. The sand and gravel are angular to subangular. The fines are nonplastic, and do not react to HCl.					
		SM	**Silty Sand (127 - 131)** Dry, very dense, no odor. Primarily medium to fine sand with ~10% gravel to 15 mm and ~30% silt and					

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 8 **of** 11

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
130			clay. The gravel is angular to subangular and the sand is subangular to subrounded. The fines are nonplastic, and do not react to HCl.					
		SM	**Silty Sand (131 - 132)** Dry, very dense, no odor. Primarily medium to fine sand with ~5% gravel to 15 mm and ~40% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and do not react to HCl.					
		SW-SM	**Well-Graded Sand with Silt and Gravel (132 - 139.5)** Dry, very dense, no odor. Primarily medium to fine sand with ~20% gravel to 20 mm and ~20% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have no reaction to a weak reaction to HCl.					
135								
140		SW	**Well-Graded Sand (139.5 - 144)** Dry, dense, no odor. Primarily medium to fine sand with ~5% gravel to 15 mm and ~10% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and have a strong reaction to HCl.					
		SW-SM	**Well-Graded Sand with Silt (144 - 146.5)** Dry, dense, no odor. Primarily medium to fine sand with ~10% gravel to 10 mm and ~30% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have no reaction to a weak reaction to HCl.					
145								
		SM	**Silty Sand (146.5 - 149)** Dry, very dense, no odor. Primarily medium to fine sand with ~10% gravel to 20 mm and ~40% silt and clay. The gravel is angular to subangular and the sand is subangular to subrounded. The fines are nonplastic, and have no reaction to a weak reaction to HCl.					

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 9 **of** 11

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
150		CL	**Sandy Lean Clay (149 - 150)** Dry, very dense, no odor. Primarily silt and clay with ~10% gravel to 10 mm and ~20% medium to fine grained sand. The gravel is angular to subangular and the sand is subangular to subrounded. The fines have low plasticity and toughness, and have a strong reaction to HCl.					
		SM	**Silty Sand (150 - 152)** Moist, very dense, no odor. Primarily medium to fine sand with ~5% gravel to 10 mm and ~30% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and have a strong reaction to HCl.					
		CL	**Sandy Lean Clay (152 - 155.5)** Dry, very dense, no odor. Primarily silt and clay with ~10% gravel to 10 mm and ~25% medium to fine grained sand. The gravel is angular to subangular and the sand is subangular to subrounded. The fines have low to medium plasticity with low toughness, and have a strong reaction to HCl.					
155		SW-SM	**Well-Graded Sand with Silt and Gravel (155.5 - 156)** Saturated, dense, no odor. Primarily coarse to fine sand with ~20% gravel to 10 mm and ~15% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have no reaction to a weak reaction to HCl.	B/W-22@155-160				
		SM	**Silty Sand with Gravel (156 - 159.5)** Saturated, dense, no odor. Primarily medium to fine sand with ~15% gravel to 15 mm and ~25% silt and clay. The sand and gravel are angular to subangular. The fines are nonplastic, and have a strong reaction to HCl.					
160		CL	**Sandy Lean Clay (159.5 - 160)** Dry, very dense, no odor. Primarily silt and clay with ~5% gravel to 25 mm and ~10%medium to fine grained sand. The sand and gravel are angular to subangular. The fines have low plasticity and toughness, and do not react to HCl.					
		CL	**Sandy Lean Clay (160 - 162)** Dry to moist, very dense, no odor. Primarily silt and clay with ~5% gravel to 5 mm and ~30% medium to fine grained sand. The sand and gravel are subangular to subrounded. The fines have low plasticity and toughness, and do not react to HCl.					
165		CL	**Sandy Lean Clay (162 - 180)** Dry to moist, very dense, no odor. Primarily silt and clay with ~10% gravel to 15 mm and ~30% coarse to fine grained sand. The sand and gravel are subangular to subrounded. The fines have low plasticity and toughness, and do not react to HCl.					

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 10 **of** 11

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
170								
175								
180		CL	**Sandy Lean Clay (180 - 187)** Moist, very dense, no odor. Primarily silt and clay with ~5% gravel to 15 mm and ~25% medium to fine grained sand. The sand and gravel are subangular to subrounded. The fines have low to medium plasticity with low toughness, and have a weak reaction to HCl.					
185								

BORING LOG

Project Name: Yerington Second Step Hydrogeologic Framework Assessment **Project Number:** 132025

Soil Boring: ☐ Monitoring Well: ☒ Piezometer: ☐ **Boring/Well Number:** B/W-22 **Sheet** 11 **of** 11

Depth (ft)	Elevation (ft)	USCS Group Symbol	Material Description	Sample Name	Sample Location	Lithology	Well Construction	Remarks
		SC	**Clayey Sand (187 - 189.5)** Moist, very dense, no odor. Primarily silt and clay with ~5% gravel to 35 mm and 25% medium to fine grained sand. The sand and gravel are subangular to subrounded. The fines have low plasticity and toughness, and do not react to HCl.					
190		SM	**Silty Sand (189.5 - 190)** Moist, very dense, no odor. Primarily medium to fine sand with ~10% gravel to 20 mm and ~40% silt and clay. The sand and gravel are subangular to subrounded. The fines are nonplastic, and do not react to HCl.					
		CL	**Sandy Lean Clay (190 - 194.5)** Dry, very dense, no odor. Primarily silt and clay with ~10% gravel to 20 mm and ~20% medium to fine grained sand. The sand and gravel are subangular to subrounded. The fines have low plasticity and toughness, and do not react to HCl.					
195		CL	**Sandy Lean Clay (194.5 - 197)** Dry, very dense, no odor. Primarily silt and clay with ~5% gravel to 20 mm and ~25% coarse to fine grained sand. The sand and gravel are subangular to subrounded. The fines have low to medium plasticity with low toughness, and do not react to HCl.					
			Bottom of Borehole at 197 feet below ground surface.					